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TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/787690

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/GB99/01958	June 23, 1999	September 22, 1998

TITLE OF INVENTION
FILTERS

JC07 Rec'd PCT/PTO 21 MAR 2001

APPLICANT(S) FOR DO/EO/US
David Gordon Stevenson

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [XX] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [XX] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [ ] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [XX] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [X] is attached hereto (required only if not communicated by the International Bureau).
   b. [ ] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [ ] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [ ] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [X] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [X] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [X] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [X] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [ ] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [X] Other items or information:
    Application Data Sheet
    Copies of International Search Report and International Examination Report

APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO		ATTORNEY'S DOCKET NUMBER
09/787690	PCT/GB99/01958	IC02 Rec'd PCT/PTO 21 MAR 2001	33415

21. [X] The following fees are submitted:

	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1000.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$860.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$710.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$690.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 860.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	23 - 20 =	3	x **$18.00**	$ 54.00	
Independent claims	1 - 3 =	0	x **$80.00**	$ 0.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$270.00**	$	
TOTAL OF ABOVE CALCULATIONS =				$ 914.00	
[ ] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.			+	$	
SUBTOTAL =				$ 914.00	
Processing fee of **$130.00** for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$	
TOTAL NATIONAL FEE =				$ 914.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$	
TOTAL FEES ENCLOSED =				$ 914.00	
				Amount to be refunded:	$
				charged:	$

a. [X] A check in the amount of $ 914.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 16-0820 . A duplicate copy of this sheet is enclosed.

d. [ ] Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

SIGNATURE

Thomas P. Schiller

NAME

20677

REGISTRATION NUMBER

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: David Gordon Stevenson

Title: FILTERS

Docket No.: 33415

PRELIMINARY AMENDMENT

Box PCT
Commissioner for Patents
Washington, D.C. 20231

Sir:

Please amend the above-referenced application prior to its examination as follows:

IN THE CLAIMS:

1. (amended) A device for admitting a backwash fluid to filter medium of a filter bed, comprising:

(i) a member;

(ii) a plurality of elongate orifices through said member;

(iii) whereby to allow passage therethrough of said fluid but not the media.

2. (amended) A device as defined in claim 1, wherein the elongate through orifices each comprise a slot.

3. (amended) A device as defined in claim 2, wherein the slots each have a width of less than 0.5 mm.

4. (amended) A device as defined in claim 2, wherein the slots each have a width between 0.1-0.3 mm.

5. (amended) A device as defined in claim 2, wherein each slot has a width of 0.25 mm.

6. (amended) A device as defined in claim 2, wherein the member comprises a tube and wherein the slots are directed longitudinally of the tube.

7. (amended) A device as defined in claim 2, wherein the member is a corrugated member, and wherein the slots are in walls of the corrugation and directed longitudinally thereof.

8. (amended) A device as defined in claim 6, wherein the slots are arranged in groups of a plurality of slots.

9. (amended) A device as defined in claim 7, wherein the slots are arranged in groups of a plurality of slots.

10. (amended) A device as defined in claim 9, wherein the slots are arranged in more than one row.

11. (amended) A device as defined in claim 8, wherein the slots are arranged in rows whereby to provide slots both close to the bottom and to the top of the tube in any orientation of the tube.

12. (amended) A device as defined in claim 10, wherein the length of each slot is not greater than the longitudinal pitch along a particular row of slots.

13. (amended) A device as defined in claim 11, wherein the length of each slot is not greater than the longitudinal pitch along a particular row of slots.

14. (amended) A device as defined in claim 12, wherein the slots are staggered along the length of the member.

15. (amended) A device as defined in claim 13, wherein the slots are staggered along the length of the member.

16. (amended) A device as defined in claim 2, wherein the slots are formed by a laser cutting device.

17. (amended) A device as defined in claim 16, wherein the members are selected from a group of materials consisting of stainless steel, brass, aluminum, and plastic.

18. (amended) A system for backwashing a filter medium of a filter bed, comprising:

(i) a plurality of members as defined in claim 1; and

(ii) wherein said members extend substantially in spatial relation one with another and wherein each is connected with a fluid supply means.

19. (new) A system as defined in claim 18, wherein the fluid supply means comprises a supply pipe for each member and a common manifold to which each supply pipe is connected.

20. (new) A filter, side walls and a base, and wherein there is installed a system as defined in claim 19.

21. (new) A filter as defined in claim 20, wherein the members extend laterally of the filter.

22. (new) A filter as defined in claim 21, wherein the members are positioned at the base of the filter.

23. (new) A filter as defined in claim 22, wherein the members are positioned adjacent the base of the filter.

If there are any fees resulting from this communication, the Commissioner is hereby authorized to charge such fees or credit any overpayment to our Deposit Account No. 16-0820, Order No. 33415.

Respectfully submitted,
PEARNE & GORDON LLP

By Thomas P. Schiller
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Date: March 21, 2001

MARKED-UP CLAIMS SHOWING CHANGES

1. (amended) A device for admitting a backwash fluid to filter medium of a filter bed, comprising [a member having a plurality of elongate through orifices adapted to allow passage therethrough of the fluid but not the media]:

(i) a member;

(ii) a plurality of elongate orifices through said member;

(iii) whereby to allow passage therethrough of said fluid but not the media.

2. (amended) A device [according to] as defined in claim 1, wherein the elongate through orifices each [comprising] comprise a slot.

3. (amended) A device [according to] as defined in claim 2, [the slots having] wherein the slots each have a width of less than 0.5 mm.

4. (amended) A device [according to] as defined in claim [3] 2, [the width being] wherein the slots each have a width between 0.1-0.3 mm.

5. (amended) A device [according to] as defined in claim [4] 2, [the width being] wherein each slot has a width of 0.25 mm.

6. (amended) A device [according to] as defined in

[any of claims 2 to 5] claim 2, [the member comprising] wherein the member comprises a tube and [the slots being] wherein the slots are directed longitudinally of the tube.

7. (amended) A device [according to] as defined in [any of claims 2 to 5] claim 2, [the member being] wherein the member is a corrugated member, and [the slots being] wherein the slots are in walls of the corrugation and directed longitudinally thereof.

8. (amended) A device [according to] as defined in claim 6 [or claim 7], [the slots being] wherein the slots are arranged in groups of a plurality of slots.

9. (amended) A device [according to] as defined in claim [8] 7, [the slots being] wherein the slots are arranged in groups of a plurality of slots.

10. (amended) A device [according to] as defined in claim 9, [the slots being arranged in rows so that they provide slots both close to the bottom and to the top of the tube in any orientation of the tube] wherein the slots are arranged in more than one row.

11. (amended) A device [according to] as defined in [claim 9 or claim 10] claim 8, [the length of each slot not being greater than the longitudinal pitch along a particular row of slots] wherein the slots are arranged in rows whereby

to provide slots both close to the bottom and to the top of the tube in any orientation of the tube.

12. (amended) A device [according to] as defined in claim [11] 10, [the slots being staggered along the length of the member] wherein the length of each slot is not greater than the longitudinal pitch along a particular row of slots.

13. (amended) A device [according to] as defined in [any of claims 2 to 12] claim 11, [the slots being formed by a laser or other thermal cutting device] wherein the length of each slot is not greater than the longitudinal pitch along a particular row of slots.

14. (amended) A device [according to] as defined in claim [13] 12, [the members comprising stainless steel, brass, aluminum or plastic] wherein the slots are staggered along the length of the member.

15. (amended) [A system for backwashing a filter medium of a filter bed, comprising a plurality of members according to any previous claim, extending substantially parallel to or radially of one another and each being connected with a fluid supply means] A device as defined in claim 13, wherein the slots are staggered along the length of the member.

16. (amended) [A system according to claim 15, the fluid supply means comprising a supply pipe for each member and a

common manifold to which each supply pipe is connected] A device as defined in claim 2, wherein the slots are formed by a laser cutting device.

17. (amended) [A filter, comprising a system according to claim 16] A device as defined in claim 16, wherein the members are selected from a group of materials consisting of stainless steel, brass, aluminum, and plastic.

18. (amended) [A filter according to claim 17, the members extending laterally of the filter] A system for backwashing a filter medium of a filter bed, comprising:

(i) a plurality of members as defined in claim 1; and

(ii) wherein said members extend substantially in spatial relation one with another and wherein each is connected with a fluid supply means.

19. (amended) A system [according to] as defined in claim 18, [the members being positioned at or adjacent the base of the filter] wherein the fluid supply means comprises a supply pipe for each member and a common manifold to which each supply pipe is connected.

20. (new) A filter, side walls and a base, and wherein there is installed a system as defined in claim 19.

21. (new) A filter as defined in claim 20, wherein the members extend laterally of the filter.

22. (new) A filter as defined in claim 21, wherein the members are positioned at the base of the filter.

23. (new) A filter as defined in claim 22, wherein the members are positioned adjacent the base of the filter.

FILTERS

The invention relates to a filter, particularly to granular media filters for removing impurities from water in for example water treatment works.

Granular media filters as generally used in water treatment comprise a bed such as sand, anthracite, or the like particulate material, either alone or in combination, contained within a tank or pressure vessel and supported on a porous floor system connected to an outlet.

Water to be filtered is usually fed in at the top, flows through the porous granular bed and out through the floor, or underdrain, systems. The latter must be able to support the dead weight of the medium as well as the pressure loss resulting from the flow and also it must be porous to permit the water to pass while retaining the granular medium in position without passing to the outlet.

In addition, in most types of filter accumulated dirt is removed by passing water in the reverse direction at a higher rate than the forward flow. The distribution of this backwash water is in fact a more critical design feature than the forward flow.

There must be a minimum pressure loss at the point of discharge into the bed to achieve the desired evenness of flow across the bed. There are two factors that have to be considered, firstly the uniformity of flow into an empty filter through the ducts or pipes of the floor or underdrain, and secondly the control of the flow into the bed itself which has an unstable characteristic and can break down from even fluidisation into a situation known as spouting or boiling.

Indeed the rapid sand filtration process for the purification of water was invented early this century and is still used in a broadly similar form. Water treated with chemicals to collect contaminants into tiny particles is passed down through a bed of sand and the contaminants are retained by the sand allowing clean water to be collected in an underdrain system beneath the sand.

A variety of methods have been used to avoid particles of sand being carried down into the underdrain system, ranging from layers of gravel of decreasing size above the holes into the underdrains to the underdrains fitted with nozzles. A further general type of underdrain system comprises a plenum floor of porous material which allows water to flow through the pores.

It is common practice in washing filters to use gas, usually air to assist washing either before water or simultaneously with it. The same underdrain system should therefore be capable of distributing this air uniformly in the same way as with water.

Granular media filters, such as sand filters are generally cleaned of accumulated contaminant particles on a batch basis, using a backwashing process. The backwashing process is primarily a reverse flow of water up through the sand which carries the accumulated contaminants away to waste. In many filters, this process is improved by a flow of air up through the bed of sand which further agitates the sand grains and facilitates the removal of the contaminants.

In some designs of filter, the air and the backwash water are introduced concurrently through individual nozzles for distributing the upwards

flows of water and air respectively. In the majority of existing filters, the air flow precedes the water flow, with the air bubbles serving to loosen adhering contaminants for the water flow to carry away. The air assists the cleaning process by providing agitation.

Some modern systems utilise air and water distributed concurrently into the base of the sand bed, providing a combined air and water backwash. This is more effective than the separate air and water flows but requires special provisions to maintain the uniform distribution of air and water per unit area of filter floor. In some systems the air and water are combined in special nozzles below the sand. In other systems, the air and water are distributed separately and allowed to mingle close to the bottom of the sand bed so that virtually all of the sand bed is subject to a mixture of rising air and water.

Where a separate air distribution system is used, then a key factor is that the minimum aperture size through which the air or water, whether separate or combined, is introduced must be a small proportion of the minimum selected sand grain size to prevent ingress of the sand.

The second requirement for the means of introducing air is that the amount of air introduced to the bottom of the filter must be almost constant per unit area of filter floor, so that a similar amount of air rises up through each portion of the sand in the filter. Were this not the case, then it would be necessary to introduce excessive air into some parts of the filter to ensure an adequate flow to those parts receiving the least. If sufficient air is not supplied, then the sand would become clogged in those parts receiving inadequate air and the clogging would tend to propagate further into the sand bed, leading to failure of the

process.

In many designs the air and water are fed through the same ducts or pipes but the rates are then limited otherwise maldistribution occurs. A common alternative is the use of suspended floors with a plenum chamber below. The depth of the latter guarantees low velocities and stable uniform distribution but with the penalty of additional tank depth and often additional excavation.

To provide the necessary headlosses for distribution and to retain the medium nozzle strainer devices are extensively used. These add to the cost of the underdrain and also can be damaged, in some cases allowing the medium into the plenum or lateral pipes below.

Another prior system involves perforated lateral pipes which are buried in graded gravel of decreasing size from bottom to top. Hitherto it has not been possible to place the working media around the lateral without using gravel, in an economical manner, because of cost limitations and the difficulty of forming fine orifices in long lengths of pipe.

It is possible to operate with air and water distributed in sequence from the same lateral pipe, but difficult with air and water simultaneously over the lengths required for large filters as used in public water supply.

It is accordingly an object of the invention to seek to mitigate these disadvantages.

According to a first aspect of the invention there is provided a device for admitting a backwash fluid to filter medium of a filter bed,

comprising a member having a plurality of elongate through orifices adapted to allow passage therethrough of the fluid but not the media.

Thus, using the invention it is possible to provide elongate orifices, or slits or slots, hereinafter "a slot" or "slots" having a width less than the finest fraction of the filter medium.

The slots may each have a width of less than 0.5mm, suitably between 0.10 - 0.3mm and preferably about 0.25mm. This is operative in use to ensure that the finest fraction of media does not penetrate the member.

The member may comprise a tube and the slots may be directed longitudinally of the tube. This is a relatively simple yet effective construction.

The member may be a corrugated member, and the slots may be in walls of the corrugation and directed longitudinally thereof. This again provides a relatively simple yet effective construction.

The slots may be arranged in groups of a plurality of slots. This provides an effective arrangement for backwashing.

The slots may be arranged in more than one row. This provides for even distribution of air for backwashing.

The slots may be arranged in rows so that they provide slots both close to the bottom and to the top of the tube in any orientation of the tube. This again provides for effective backwashing.

The length of each slot may be not greater than the longitudinal pitch along a particular row of slots. This provides for effective backwashing too, particularly as the slots may be staggered along the length of the member.

The slots may be formed by a laser or other thermal cutting device, and may comprise any suitable material, such as for example stainless steel, brass, aluminium or plastic.

According to a second aspect of the invention there is provided a system for backwashing a filter medium of a filter bed, comprising a plurality of members as hereinbefore defined, extending substantially parallel to or radially of one another and each being connected with a fluid supply means.

The fluid supply means may comprise a supply pipe for each member and a common manifold to which each supply pipe is connected.

According to a third aspect of the invention there is provided a filter, comprising a system as hereinbefore defined.

The members may extend laterally of the filter, suitable at or adjacent the base of the filter.

Devices, systems and granular media filters embodying the invention are hereinafter, described by way of example, with reference to the accompanying drawings.

Fig. 1 is a schematic perspective view of one embodiment of sand filter

according to the invention;

Fig. 2 is an elevational view of part of a member according to the invention, to a larger scale than Fig. 1;

Fig. 3 is an enlarged view of detail 'A' of Fig. 2;

Fig. 4 is an enlarged view of detail 'B' of Fig. 3;

Fig. 5 is a schematic perspective view, partially broken away, of a second embodiment of granular media filter according to the invention;

Fig. 6 shows to a larger scale than that of Fig. 5, a section through the filter floor;

Figs. 7 and 8 show, again to an enlarged scale respective perspective and transverse sectional views of "laterals" for air used in the filter of Figs. 5 and 6;

Fig. 9 shows an embodiment of granular media filter according to the invention where a feed manifold is buried in filter media; and

Figs. 10 shows an embodiment of granular media filter according to the invention utilising alternating water and air laterals.

Referring to the drawings there is shown in Fig. 1 a filter 1 which has a backwashing system 2 comprising a plurality of members in the form of slotted stainless steel pipes or tubes, or "laterals", 3 extending laterally of the filter below the filter medium, sand in the embodiment,

each tube being substantially parallel and each being connected in the embodiment to a manifold or air supply pipe 5 by a respective supply means or downpipe 6.

Each tube 3 has a plurality of longitudinally extending slots 7, through the circumference of the tubes, the slots being in the embodiment 0.25mm in width and being arranged in groups of three at different "levels", the two "upper" 7', 7" ones as viewed and as in use being angularly spaced by 120°, and the lower one 7''' being in use on the floor of the filter. The slots are preferably formed by a laser cutting device to provide uniformity of width and length, and with little or no swarf.

The filter includes water nozzles 8.

Referring now to Figs. 5 to 10, a second embodiment of sand filter is shown in Fig. 5 which comprises a structure 10 most often in concrete but frequently in steel with side walls 11 and a side channel 12 and duct 13 to provide means of feeding and collecting through flow of water and also backwash water. A granular filtering medium 14 is supported on a floor 15 which incorporates or supports a matrix of nozzles or orifices 16 which collect the filtrate and distribute the backwash water. In the kind of floor shown these orifices or nozzles 16 connect with a set of lateral pipes or manifolds 17 which in turn connect with the main feeder/collector duct or pipe 13.

To assist washing, air may be applied sequentially or simultaneously. In the kind of filter floor described this is achieved by laying a second set of lateral pipes 18 in between the water nozzles 16 or above them.

These air laterals 18 are fed from an air manifold 19 which may be located above the filter medium 14 as in Fig. 5 or buried within it. Fig. 6 shows a section of an arrangement with water laterals 17 set in the concrete floor 15 and with air laterals 18 set above, and within the sand 14.

The air laterals 18, as described, are perforated with lines of fine slots 20 spaced around the lateral pipe as illustrated in Figs. 7 and 8.

Fig. 9 shows an embodiment where the feed manifold 19 is buried in the medium 14 and is also slotted to admit air and retain the medium. In this way the medium above the manifold is also aerated and cleaned.

Fig. 10 shows an embodiment with alternating water 17 and air 18 laterals, where the former are not buried in the concrete but laid above it. In this case the water laterals are not connected to strainers but are of a similar design to the air laterals and are slotted similarly. They will normally be of larger diameter. In this case the water laterals if used in a filter similar to that shown in Fig.5 would still penetrate the wall of the filter into the duct 13.

Thus, in the embodiments of the invention fine slit lateral tubes, pipes or ducts are used to perform all the necessary functions. The slots, or slits, have a width less than that of the finest fraction of the granular medium so that super-imposed gravel layers are no longer necessary. These lateral pipes are suitably laid directly on the structural floor of the filter to distribute and collect water. They may also be used for the distribution of air and water in sequence. Where air is to be applied simultaneously separate systems of air and water distribution lateral

pipes may be laid between each other so that alternate pipes admit water and air respectively during washing.

In an alternative, separate air lateral systems are laid above or in between conventional lateral systems, or above gravel packing layers and in conjunction with nozzles which are then used for distribution of water only. One advantage of the separate lateral system is its suitability for retrofit conversions from separate sequential air and water to simultaneous air and water.

A particular feature of the fine slit or slotted pipe is the absence of separate components which as well as adding to cost can also become damaged. The length and width of the slits or slots and their spacing are as desired and the pressure loss is selected to achieve the intended accuracy of distribution. Because there are no intrusions into the pipe, as with many types of nozzle, the required accuracy can be achieved over longer lengths of pipe.

The avoidance of additional components and the labour involved in fitting them also reduces costs.

In one form pipes for use in filter underdrains may be slit with a fine slitting saw, but below 0.4mm these become rather fragile. Also sawing may create swarf which may block the slits unless considerable care is exercised.

In a preferred form laser cuts are used to achieve finer slits or slots. In this case the cut has a fused edge and a stringy swarf is not produced.

It is also preferred that the slits or slots be longitudinal (in contrast to common drainage pipes which are transverse) as in this direction the bending strength of the pipe is not compromised by the slit to the same extent.

It is inevitable that air lateral pipes will fill with water while the filter is in service. Laterals for water likewise may occasionally receive some air (e.g. on start up). Slits are therefore arranged in more than one line round the circumference of the pipe to permit filling and emptying, and the pressure loss through the slits during backwashing is always well in excess of the pressure difference corresponding to the head of water of the diameter.

In addition to laser cutting, and bearing in mind the sizes of filter media currently in use, other methods of forming fine slits may be used.

These could involve fusion of the pipe material, shearing as with expanded metal, and abrasive jet cutting.

By way of example and without restricting the scope of the invention, pipes used for water distribution may have a diameter of 50 to 150mm depending on the length and specific flow rate required, in lengths of several metres.

For air, typical diameters are 20 to 40mm e.g. in a preferred embodiment up to 38mm, say 32mm. Slits may be 0.15 - 0.3mm width and of lengths not exceeding the longitudinal pitch, but as required by the pressure loss calculations. Backwash water and air flow rates both range typically from 4 to 20 litres/m^2/second. The spacing between

lateral pipes and the pitch of the slits along the pipes is usually between 150mm and 250mm, but may be outside these limits.

It is usual to connect lateral pipes of such sizes to a larger diameter "header" or feed pipe or pipes which penetrate the outer wall of the tank or vessel. Such headers can cast a shadow on the bed and cause the medium over them to be washed less efficiently. It is a further feature of the invention that such headers may also be cut in a similar way to distribute air, and so eliminate such shadows.

In the above it has been assumed that the slits are formed in a circular section pipe. Rectangular or square ducts may also be slit to allow air or water to be distributed. This may be preferred in the case of headers, which can then be fitted against the wall or bottom corner of the vessel.

Lastly for distribution and collection of water the fine slits or slots described above may be arranged as a matrix in flat or corrugated floor panels. In the latter case rows of slits may be provided at different heights in the side of the corrugations and air may be distributed from below into the inverted channels of the corrugated sheet and thence via the upper slits into the granular media above. The corrugations then act as a set of lateral pipes. However the pressure loss for air will be limited by the height of the corrugations. Also, the slits or slots may be formed in a rollable material, which when rolled into a tubular form provide a device embodying the invention.
It will be understood that the invention described with reference to the drawings may be modified.

Thus, the tubes 3 may extend directly into the manifold 5 at a low level

thereof, without the need for downpipes 6. Also, there may be three or more rows of slots 7 which may be arranged in any desired respective orientation. Where there are three rows, some will be close to the top and some close to the bottom.

It will be further understood that embodiments of the invention as described herein with reference to the drawings utilize slots in a pipe or duct which perform both the function of controlling the pressure loss, and therefore the accuracy of distribution of air and/or water in a cleaning operation for the filter, as well as preventing entry of the filter medium or media into the pipe or duct, without the necessity of providing a porous structure that would in time be blocked by fine dirt and without the need to utilise expensive strainers, nozzles or other fittings attached to lateral pipes or ducts. In addition, the invention allows for adjustment of pressure loss on a site by site basis. The air in all the embodiments does not convey the dirt from the filter, which is effected by the water, but assists the cleaning process by providing agitation of the granular media so as to loosen dirt which is then carried away. This is so whether the air is introduced separately or concurrently with the water.

CLAIMS

1. A device for admitting a backwash fluid to filter medium of a filter bed, comprising a member having a plurality of elongate through orifices adapted to allow passage therethrough of the fluid but not the media.

2. A device according to Claim 1, the elongate through orifices each comprising a slot.

3. A device according to Claim 2, the slots having a width of less than 0.5mm.

4. A device according to Claim 3, the width being between 0.10 - 0.3mm.

5. A device according to Claim 4, each slot having a width of 0.25mm.

6. A device according to any of Claims 2 to 5, the member comprising a tube and the slots being directed longitudinally of the tube.

7. A device according to any of Claims 2 to 5, the member being a corrugated member, and the slots being in walls of the corrugation and directed longitudinally thereof.

8. A device according to Claim 6 or Claim 7, the slots being arranged in groups of a plurality of slots.

9. A device according to Claim 8, the slots being arranged in more

than one row.

10. A device according to Claim 9, the slots being arranged in rows so that they provide slots both close to the bottom and to the top of the tube in any orientation of the tube.

11. A device according to Claim 9 or Claim 10, the length of each slot being not greater than the longitudinal pitch along a particular row of slots.

12. A device according to Claim 11, the slots being staggered along the length of the member.

13. A device according to any of Claims 2 to 12, the slots being formed by a laser or other thermal cutting device.

14. A device according to Claim 13, the members comprising stainless steel, brass, aluminium or plastic.

15. A system for backwashing a filter medium of a filter bed, comprising a plurality of members according to any previous claim, extending substantially parallel to or radially of one another and each being connected with a fluid supply means.

16. A system according to Claim 15, the fluid supply means comprising a supply pipe for each member and a common manifold to which each supply pipe is connected.

17. A filter, comprising a system according to Claim 16.

18. A filter according to Claim 17, the members extending laterally of the filter.

19. A filter according to Claim 18, the members being positioned at or adjacent the base of the filter.

ABSTRACT

FILTERS

The invention relates to a filter 1 which has a backwashing system 2 comprising a plurality of members in the form of slotted stainless steel pipes or tubes, or "laterals", 3 extending laterally of the filter below the filter medium, sand in the embodiment, each tube being substantially parallel and each being connected in the embodiment to a manifold or air supply pipe 5 by a respective supply means or downpipe 6.

Each tube 3 has a plurality of longitudinally extending slots 7, through the circumference of the tubes, the slots being in the embodiment 0.25mm in width and being arranged in groups of three at different "levels", the two "upper" 7', 7" ones as viewed and as in use being angularly spaced by 120°, and the lower one 7''' being in use on the floor of the filter. The slots are preferably formed by a laser cutting device to provide uniformity of width and length, and with little or no swarf.

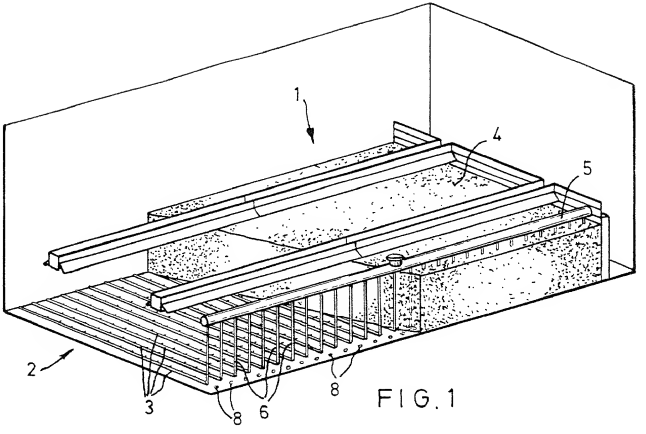

FIG. 1

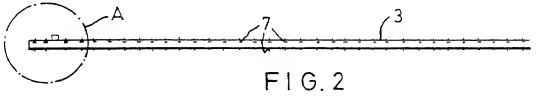

FIG. 2

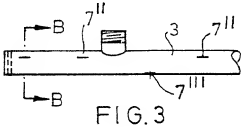

FIG. 3

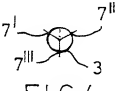

FIG. 4

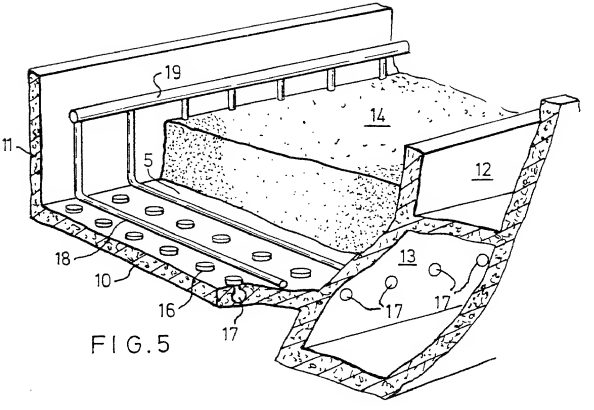

FIG.5

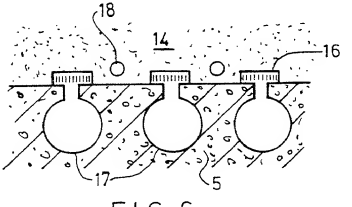

FIG.6

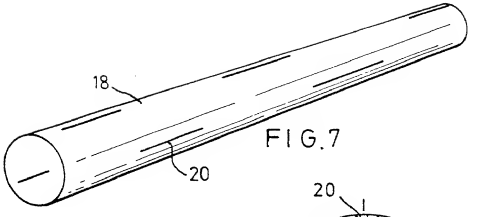

FIG.7

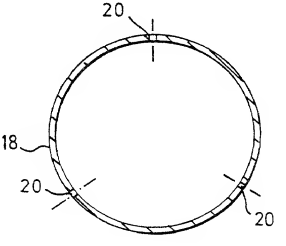

FIG.8

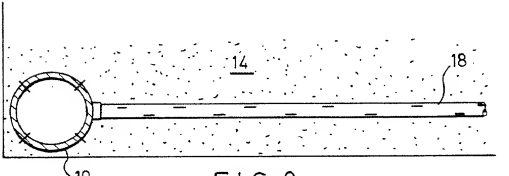

FIG.9

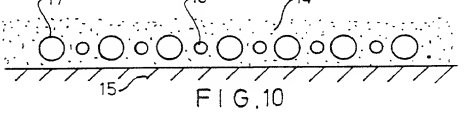

FIG.10

FP14577 (US)

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☐ Declaration Submitted with Initial Filing **OR** ☒ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	33415
First Named Inventor	D.G. Stevenson
COMPLETE IF KNOWN	
Application Number	09 / 787,690
Filing Date	March 21,2001
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

FILTERS

(Title of the Invention)

the specification of which

☐ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) [ ] as United States Application Number or PCT International Application Number [ ] and was amended on (MM/DD/YYYY) [ ] (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
PCT/GB99/01958	PCT	06/23/1999	☐	☐	☒
9820624.6	United Kingdom	09/22/1998	☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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[ ] A petition has been filed for this unsigned inventor

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NAME OF SECOND INVENTOR:

[ ] A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])

Family Name or Surname

Inventor's Signature

Date

Residence: City | State | Country | Citizenship

Mailing Address

Mailing Address

City | State | ZIP | Country

[ ] Additional inventors are being named on the ____supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.